SUPPLEMENTAL INSTRUMENTATION APPENDIX

TO PERIODIC INSPECTION REPORT NO. 4

BUFFUMVILLE LAKE

CHARLTON, MASSACHUSETTS

FEBRUARY 1992

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS 02254-9149

SUPPLEMENTAL INSTRUMENTATION APPENDIX
TO PERIODIC INSPECTION REPORT NO. 4
BUFFUMVILLE LAKE

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SUPPLEMENTAL INSTRUMENTATION APPENDIX

TO PERIODIC INSPECTION REPORT NO. 4

BUFFUMVILLE LAKE

INSTRUMENTATION FOR SAFETY EVALUATION

1. Project Performance.

The project's condition is judged to be good based on visual observations and instrumentation data. The crest monument data indicates that typically 0 to 1 inch of settlement has taken place at the dam since 1976 and 0 to 2.5 inches of horizontal movement has taken place at the dam since 1978. Larger horizontal movements (10.0 inches at A, 4.6 inches at POL-1 and 24.0 inches at POC-2) and larger settlement (7.8 inches at POL-9) were noted but are attributed to survey errors. A study to determine the number and location of piezometers needed at Buffumville Dam was performed in FY91. It recommended that two double piezometers and one single piezometer be installed at the dam in FY95 as discussed in Section 5 of this report.

2. Project Description.

a. General. The project is one unit of a system of six reservoirs and dams situated in the Thames River Basin, Connecticut and Massachusetts. The dam is located approximately 1.3 miles upstream of the French and Little Rivers confluence on the Little River in Charlton, Massachusetts as shown on Plate 1. The reservoir is located in the towns of Oxford and Charlton, Worcester County, Massachusetts. The major project features are an earth and rockfill dam, a combined spillway and outlet, and an earth and rockfill dike. Project construction was started September 1956 and was completed June 1958.

b. Geology and Foundations.

(1) Topography and Geology. Little River is located near the eastern border of the maturely dissected New England Upland. The area has low to moderate relief which has been altered by glaciation. Rounded hills and ridges form the edges of relatively, wide, flat valleys. Steep, rough, rocky slopes and channels sometimes dissect the generally rolling terrain.

A thin layer of clayey glacial till with boulders covers the hills in the area. Bedrock penetrates through the till on many of the hills. The valleys are filled with thicker layers of till and outwash materials which were deposited on the till when the glacier melted. The glacial filling of the valleys has changed the pre-glacial drainage paths so that many of the old valleys are blocked, some streams have been diverted, and many ponds and marshes occupy the wide valley bottoms. The present streams flow high above their pre-glacial channels due to the thick deposits of till and outwash. Bedrock is observed in the valleys only where streams have uncovered bedrock ridges or spurs on the sides of the old valleys.

The main valley of the Little River extends north to south like most of the valleys in the region. During the final stages of glaciation, the southward drainage path was blocked by ice and debris. Ponded water spilled over a low saddle at the eastern divide of the basin and the river cut its present eastward course along an old valley through the bedrock ridge. After the ice receded, the southward drainage path was still blocked by low deposits of glacial materials between Hayden Pond and Pierpoint Meadow Pond, so the river continued to flow eastward to the French River.

(2) Dam Site. The 0 to 60 foot thick overburden at the dam consists of outwash underlain by glacial till. The outwash is poorly to well stratified or lensed, loose to moderately compact sandy silt, silty sand, gravelly sand and sandy gravel. On the south side of the river, the outwash deposits are generally less than 10 feet thick except at the upstream end of the spillway where they are up to 20 feet thick. On the north side of the river, the outwash deposits are 5 to 10 feet thick along the crest of the ridge which runs under the centerline of the embankment. Downstream of the ridge, the outwash deposits tend to thin while upstream they are up to 20 feet thick. Near the north end of the dam, the outwash deposits become stratified silts and silty sands and increase to 40 feet in thickness.

Two phases of glacial till were observed below the glacial outwash. The upper phase is a looser, less impervious silty sand with cobbles and boulders. It was dropped in place by the receding glacier. The lower phase is a very compact, relatively impervious silty to clayey, gravelly sand with cobbles and boulders. It was deposited and compressed on the bedrock surface by actively moving ice. Both phases of the till are very variable in thickness and disappear around knolls and near the north abutment.

Exploration locations and details for the dam and appurtenant structures which give more details concerning the foundation materials are shown on Plates 2 and 3.

(3) Dike Site. The foundation materials vary from compact glacial till at the east end of the dike to glacial outwash at the west end of the dike. The glacial till is primarily semi-pervious to impervious silty sand and gravel. The outwash materials are mainly semi-pervious silty gravels with minor amounts of pervious and semi-pervious silty sands. A marshy area exists immediately downstream of the dike and is attributed to seepage through the existing road embankment.

(4) Bedrock. The bedrock under most of the foundation area is calcareous, quartz-mica schist. Granite occurs near the north end of the dam and at the north abutment. The schist is hard, fresh and broken by relatively few joints. Although the schistosity is generally well developed and the schist in many areas is phyllitic, the foliation planes are tight and the rock is considered sound and strong. The granite on the north abutment is gneissic and has occasional quartz veins and pegmatite zones. It is generally moderately hard and fresh, although some weathering has occurred along occasional joints.

(5) Groundwater. Groundwater levels measured before the construction of the dam were generally 10 to 20 feet below the surface. One exception was in the vicinity of Station 38+00 near the north end of the dam where surficial marshes and springs existed. More information pertaining to groundwater levels is shown on Plate 3.

c. Dam and Appurtenant Structures.

(1) Dam. The embankment of Buffumville Dam is a rolled earth fill which has a total length of 3,255 feet and a maximum height of 66 feet above the streambed. The limits of the embankment are shown on Plate 4. The embankment section, as shown on Plates 5, 6, and 7, consists of an impervious fill core with an upstream pervious fill zone, and downstream random fill zone. The upstream slope is covered with a 2-foot layer of stone slope protection underlain by a 1-foot layer of gravel bedding while the downstream slope is covered with a 1-foot layer of stone slope protection underlain by one-half foot layer of gravel bedding. The upstream slope is 1 vertical on 2.5 horizontal except below elevation 500 feet National Geodetic Vertical Datum (NGVD) where a 3-foot layer of stone slope protection underlain by 1 foot gravel bedding was placed. The downstream slope is 1 vertical on 2 horizontal. Seepage through the embankment is controlled by an impervious fill cutoff to glacial till, a downstream pervious blanket and a downstream toe drain.

(2) Outlet Works. The outlet works consist of an inlet channel, an inlet structure, three conduits, an outlet structure and an outlet channel as shown on Plate 8. The inlet channel is a stone-lined earth cut that is 22 feet wide at the bottom and approximately 520 feet long. It leads up to a 30 foot long U-shaped concrete inlet structure which is founded on bedrock. Three 3-foot wide by 4.5 foot high by 45 foot long concrete conduits founded on bedrock connect the inlet structure to the outlet structure. The outlet structure is a 45 foot long U-shaped concrete structure which is founded on bedrock. The outlet channel is a stone-like earth cut that is 20 feet wide at the bottom and approximately 1,000 feet long.

There are three 3 foot by 4.5 foot slide gates in the outlet works. A permanent pool is retained at Elev. 492.5. Flood operation is required during storm events because the gates are manually operated.

(3) Spillway. A chute spillway is located on the center section of Buffumville Dam as shown on Plates 4 and 8. It is separated from the embankment by the two retaining walls. The weir has a 220-foot long concrete ogee section which is founded on rock. The weir crest is at elevation 524 feet NGVD. The spillway approach and discharge channels were excavated mainly in earth. The approach channel is approxiamtely 175 feet long, 230 feet wide and has a bottom elevation of 515 feet NGVD. The discharge channel is approximately 1,000 feet long, varies in width from 22 feet to 100 feet and has a bottom elevation of 485 feet NGVD. Two 100-foot by 100-foot stilling basins with bottom elevations of 485 feet NGVD are located at the upstream end of the discharge channel.

(4) Dike. The dike embankment is 610 feet long and has a maximum height of 15 feet (crest elevation is 539 feet NGVD) as shown on Plate 9. It has an impervious fill core which is protected by one foot of

stone protection underlain by one foot of gravel bedding upstream and grass downstream. A 6-foot wide impervious fill cutoff trench was provided to reduce seepage under the dike. Foundation treatment for the dike was limited to stripping topsoil.

3. Existing Instrumentation.

Nineteen crest monuments were installed at Buffumville in 1976. They are located on the crest of the dam as shown on Plates 10, 11 and 12. The crest monuments are standard brass disks that have been set in 3-foot long concrete filled pipes. They typically are set flush with the existing bituminous pavement on the crest of the dam. It was noted that they were loose and could be moved up to 0.25 inches horizontally during the January 1989 periodic inspection.

The crest monuments are surveyed from Control Points B-127, R2-D2, J, I, H, G and F which are shown on Plates 11 and 12. The control points are standard brass disks that have been set in outcrops or concrete filled sonatubes.

4. Data Collection, Interpretation and Evaluation.

The crest monuments were surveyed June 1976, May 1978, August 1984 and January 1989. The results of the surveys are shown on Plates 11 and 12. Each survey was tied to the Massachusetts Lambert Grid System. Distances were measured using a tape for the 1976 survey and using electronic distance measuring equipment for the 1978, 1984 and 1989 surveys. Standards presently being used for settlement surveys are included in Attachment No. 1.

Plate 12 shows graphical representation of the survey results. The observed vertical movements from 1976 to 1989 typically varied between 0 and 1 inch and averaged 0.7 inches. The observed horizontal movements from 1978 to 1989 typical varied between 0 and 2.5 inches and averaged 1.2 inches. Larger movements (10 inches horizontal at A, 4.6 inches horizontal at POL-1, 24 inches horizontal at POL-2 and 7.8 inches vertical at POL-9) were observed, but they are attributed to survey error. There seems to be no trend in the horizontal movements and a small downward trend in the vertical movements.

5. Conclusions and Recommendations.

a. General. The geotechnical instrumentation at Buffumville Lake Dam presently consists of nineteen crest monuments. It is recommended that two double piezometers and one single piezometer be installed in FY95 to monitor porewater pressures in the embankment as discussed in Section 5d.

b. Crest Monuments.

(1) General. Maximum horizontal and vertical movements of 2.5 inches and 1 inch have been observed at Buffumville Dam. The maximum movements appear reasonable to expect at a project of this type.

(2) Schedule. Crest monument surveys at Buffumville Dam are scheduled once every five years to coincide with the periodic inspection schedule. The next scheduled survey is to be performed in 1994. Thesurvey schedule will be adjusted if field evidence of embankment movement occur or unusual readings are obtained from a survey.

(3) Evaluation of Adequacy. The number of crest monuments and current standards for surveying them at Buffumville Dam are adequate. A Global Position Systems Survey such as NAVSTAR which can detect movements of less than 0.2 inches (ETL 1110-1-133) will be implemented if it is cost effective.

c. Strong Motion Instruments. Strong motion instruments have not been installed at Buffumville Dam because the risk of a large earthquake at the project site is relatively low, and the cost to install, read, and maintain strong motion instruments is high.

d. Piezometers. The installation of piezometers is needed at Buffumville Dam to monitor the phreatic line within the dam embankment and foundation pore pressures. Two double piezometers and one single piezometer are recommended as shown on Plate 13. They should be located at approximately Station 18+00, 32 feet upstream, 25 feet downstream and 114 feet downstream from the dam centerline. The piezometers will measure piezometric levels in the impervious fill core (PZ-1A), the earth foundation (PZ-11B and PZ-21B), the random fill zone (PZ-2A), and the downstream pervious blanket (PZ-3) of the dam. The estimated cost for the installation of the proposed piezometers is $40,000. The estimated cost includes associated engineering, supervision and administration. The work should be scheduled and budgeted for FY95.

The following standards and procedures are employed for Crest Monument Surveys at Buffumville Dam.

STANDARDS FOR SETTLEMENT SURVEYS

1. Control points are stamped brass disks preferably set in a ledge area. Where no ledge is available, they are set in concrete bounds placed flush with the ground.

2. Control points are set in areas such that the maximum possible number of crest monuments on the dam are visible.

3. Control points are tied into four reference points by distance. This provides a check each time they are occupied for settlement surveys or allow them to be replaced if found to be destroyed.

4. Distances are read and recorded between settlement bounds. Both distance and angle are read and recorded from the control points that are being occupied to locate each settlement bound on the dam.

5. In locating each settlement bound, a control point will be occupied setting 0-00'-00" (referenced line of site) on a second control point, reading and recording both interior and exterior angle closure, along with distances through each settlement bound located on the dam. Each settlement bound is located from a minimum of two control points. These locations are third order, class II survey with relative accuracies of not less than 1 part in 5,000.

6. Levels are run from control points through each settlement bound on the dam with a return run back into the control points to check the elevation closure on the run. Closure tolerance should be no greater than 0.05'. These levels are third order, class I survey with relative accuracies not less than 1 part in 10,000.

7. Crest monument surveys are performed using Topcon EDM Total Stations and recording both horizontal angles and horizontal distances.

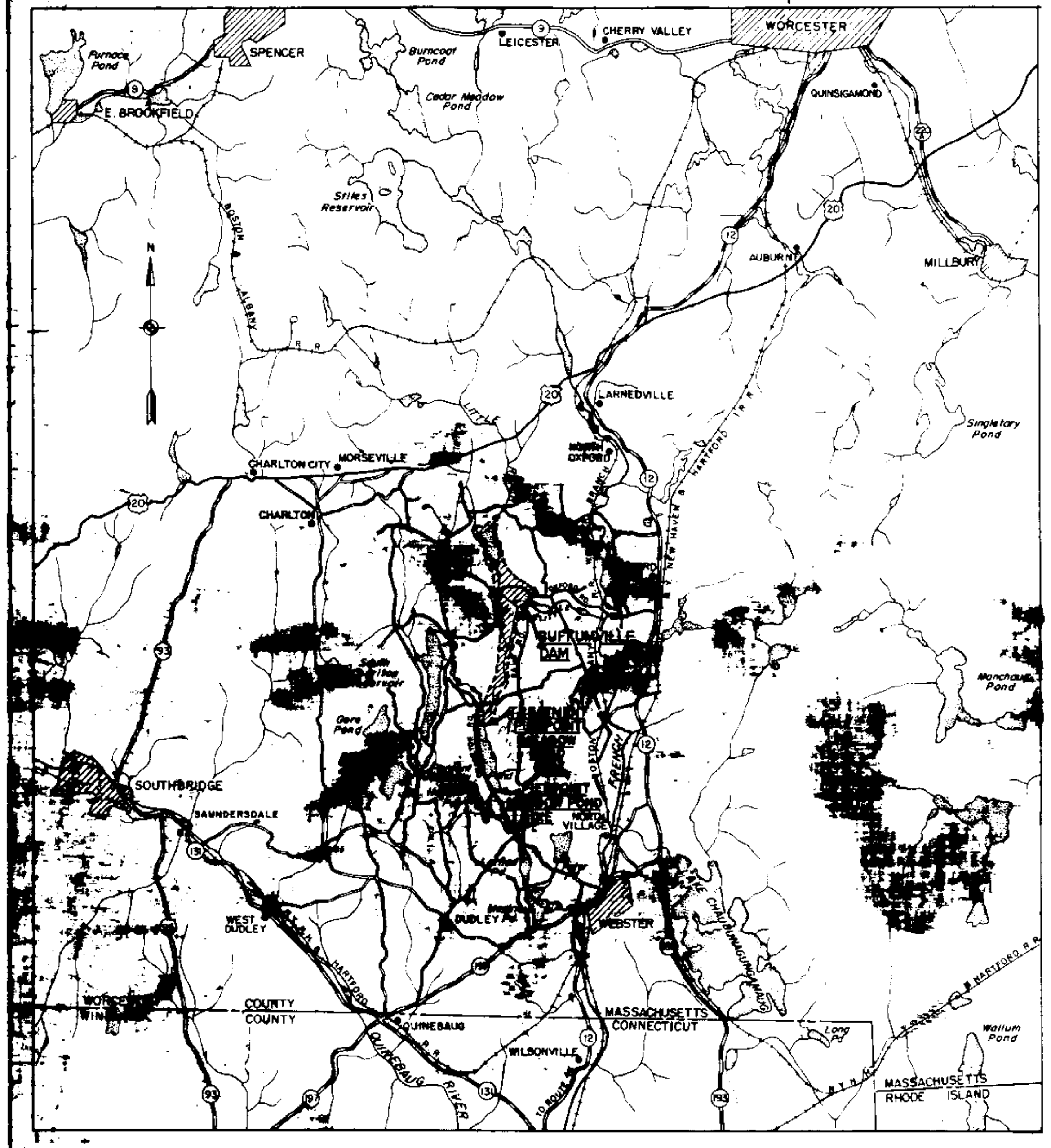
PROCEDURE FOLLOWED FOR SETTLEMENT SURVEYS

The horizontal and vertical monitoring plan for settlement bound movement points employed a combination of triangulation and trilateration angle and distance techniques to survey the control network. Control points, in the form of stamped brass disks, were placed off the dam structure in areas from which the entire length of the dam is visible. Settlement bounds themselves, with stamped brass disks, were placed on the dam structure in a location that is clearly visible from the control points. Horizontal coordinates of the control points are based on the State Plane Coordinate System. Elevations of the control points are based on the National Geodetic Vertical Datum (NGVD). Control points are occupied utilizing an EDM Total Station; observed distances and angles (interior and exterior angles), between control points and settlement bound establishing permanent bench marks. Standard leveling techniques are followed. Levels are double run and the means of the front and back runs were computed and recorded.

Attachment 1

DATA ADJUSTMENT

A combination of triangulation and trilateration surveying techniques are applied. Each crest monument is located from two control points and two sets of coordinates are calculated using adjusted field angles and compliments and EDM distances. The two sets of coordinates are averaged to give a net result. The averaged coordinates are then established on each settlement bound for use in determining shifts in the dam surface structure over a period of years by comparing repetitive surveys.



VICINITY MAP

1:62,500 (1 IN = APPROX 1 MI)

U.S. Highways
State Highways
Railroads
State Lines
Rivers
Flow Lines (Spillway Crest Elev.)
Town and County Roads

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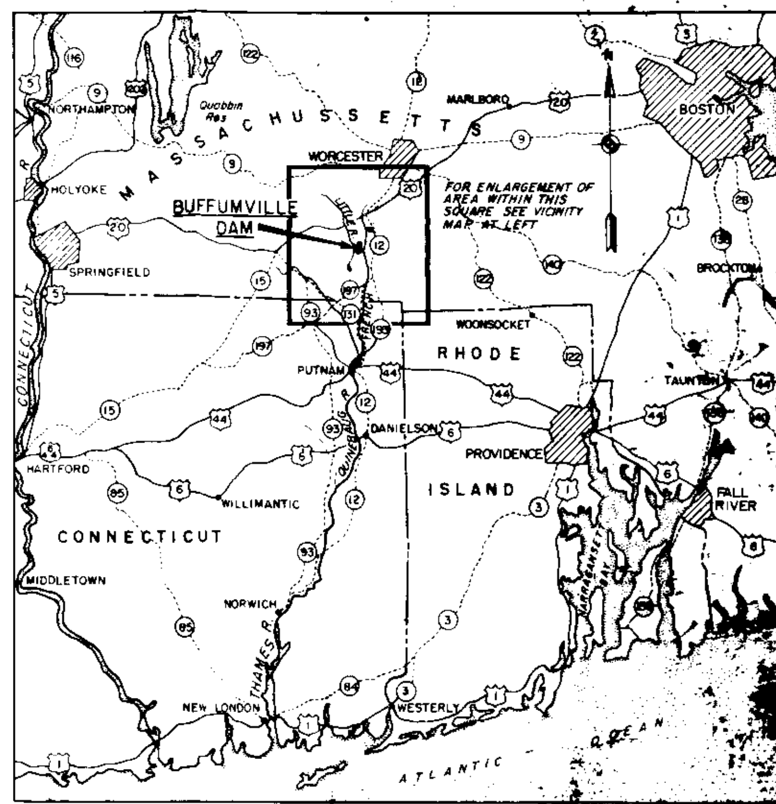

LOCATION MAP

SCALE IN MILES

LEGEND

U.S. Highways
State Highways
State Lines
Rivers

△1	7-30-56	New Drawing Added (Add #1)
REVISION	DATE	DESCRIPTION

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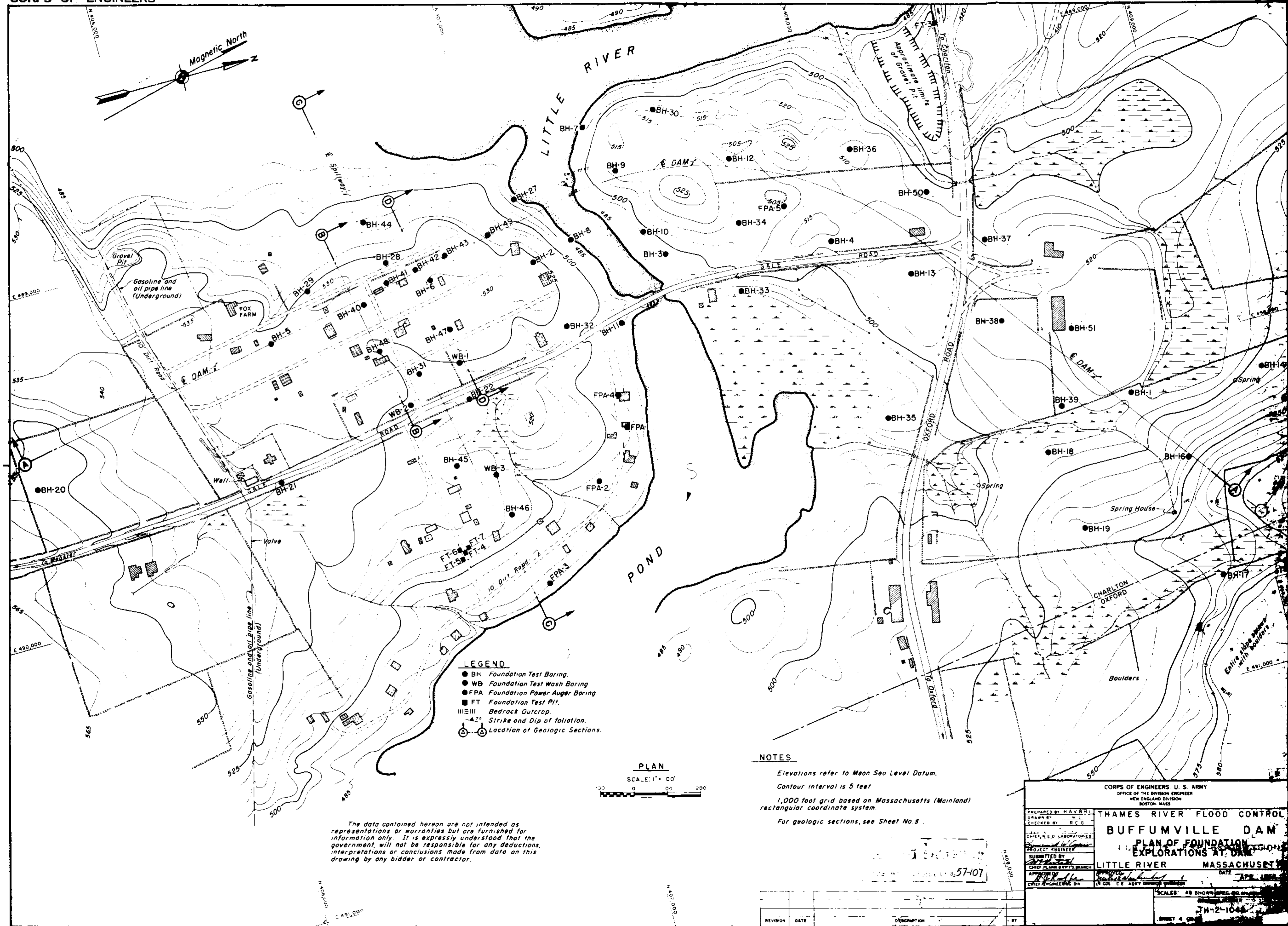
DES. BY | DR. BY S.G. | CK. BY M.J.

THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
PROJECT LOCATION


Magnetic North
LITTLE RIVER
POND
GALE ROAD
OXFORD ROAD
To Charlton
To Oxford
To Webster
CHARLTON
OXFORD
Approximate limits of Gravel Pit
Gravel Pit
Gasoline and oil pipe line (Underground)
FOX FARM
10' Dirt Road
℄ DAM
℄ Spillway
Well
Valve
Spring
Spring House
Boulders
Entire slope strewn with boulders
BH-2
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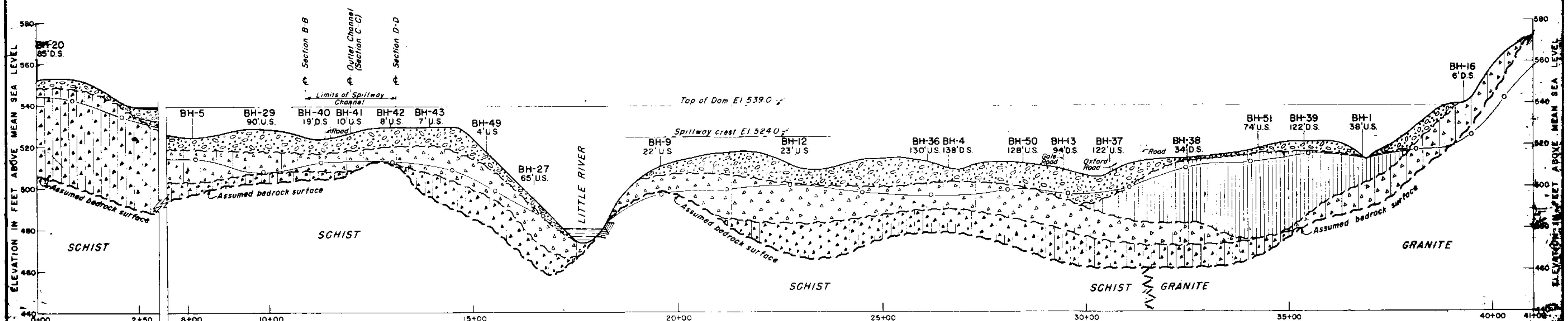
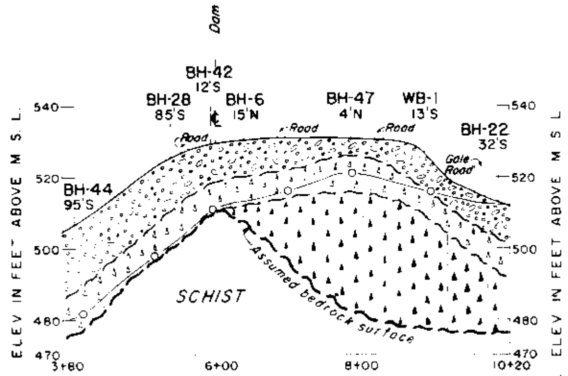
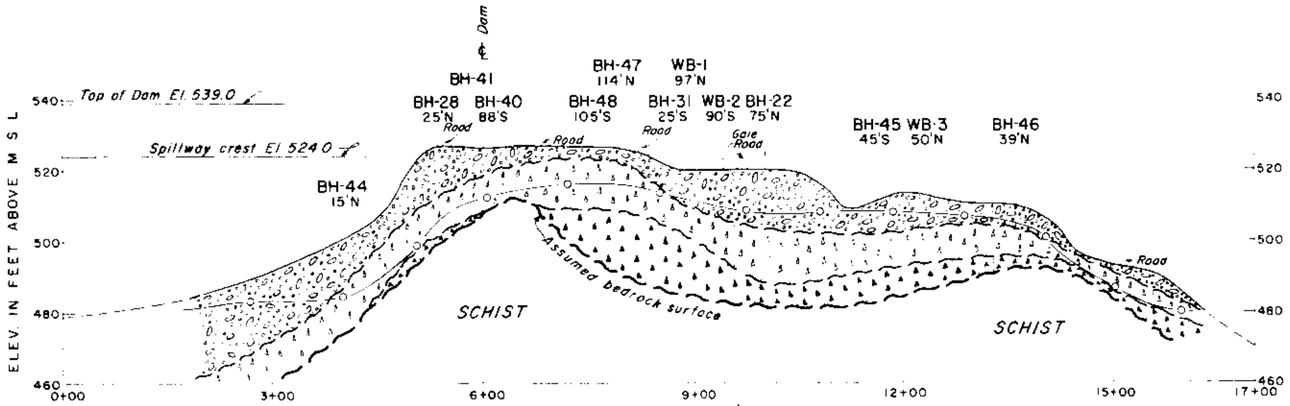
BH-51
WB-1
WB-2
WB-3
FPA-1
FPA-2
FPA-3
FPA-4
FPA-5
FT-3
FT-4
FT-5
FT-6
FT-7
LEGEND
BH Foundation Test Boring.
WB Foundation Test Wash Boring.
FPA Foundation Power Auger Boring.
FT Foundation Test Pit.
Bedrock Outcrop.
Strike and Dip of foliation.
Location of Geologic Sections.
PLAN
SCALE: 1" = 100'
100 0 100 200
NOTES
Elevations refer to Mean Sea Level Datum.
Contour interval is 5 feet
1,000 foot grid based on Massachusetts (Mainland) rectangular coordinate system.
For geologic sections, see Sheet No. 5.
The data contained hereon are not intended as representations or warranties but are furnished for information only. It is expressly understood that the government will not be responsible for any deductions, interpretations or conclusions made from data on this drawing by any bidder or contractor.
57-107
REVISION
DATE
DESCRIPTION
BY
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS
PREPARED BY H.A.V. & H.L.
DRAWN BY H.L.
CHECKED BY R.C.G.
CHIEF, N.E.D. LABORATORIES
PROJECT ENGINEER
SUBMITTED BY
CHIEF, PLANN. & RPT'S BRANCH
APPROVED
CHIEF, ENGINEERING DIV
THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
PLAN OF FOUNDATION EXPLORATIONS AT DAM
LITTLE RIVER MASSACHUSETTS
APPROVED
LT. COL. C.E. ASS'T DIVISION ENGINEER
DATE
SCALES: AS SHOWN
TH-2-1046



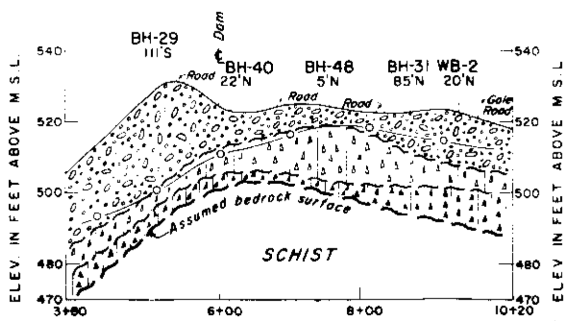
GEOLOGIC SECTION A-A, ℄ DAM
(LOOKING UPSTREAM)



GEOLOGIC SECTION D-D, 110' NORTH OF SPILLWAY ℄
(LOOKING NORTH)



GEOLOGIC SECTION C-C, ℄ SPILLWAY
(LOOKING NORTH)



GEOLOGIC SECTION B-B, 110' SOUTH OF SPILLWAY ℄
(LOOKING NORTH)

The data contained hereon are not intended as representations or warranties but are furnished for information only. The interpretations of subsurface conditions as shown in sections contained on this drawing are only diagrams of assumed geology and are not to be used as a reliable basis for preparing estimates. It is expressly understood that the government will not be responsible for any deductions, interpretations or conclusions made from data on this drawing by any bidder or contractor.

NOTES

For record of foundation explorations, see Sheets No. 6 and 7

For locations of geologic sections and explorations, see Sheet No. 4

LEGEND FOR GEOLOGIC SECTIONS

- Varies from silty, sandy GRAVEL to gravelly, silty SAND — Loose, roughly stratified or lensed, pervious to semi-pervious
- Generally gravelly, silty SAND with cobbles — Loose to moderately compact, semi-pervious to relatively impervious. (Sandy TILL)
- Generally silty, gravelly SAND with cobbles and occasional boulders — Compact, relatively impervious (TILL)
- SILT and silty SAND — Stratified, loose to moderately compact, semi-pervious to relatively impervious.
- o—o—o Subsurface water level.

Record Drawing
EN-57-107

REVISION	DATE	DESCRIPTION	BY
1	7/30/56	Note deleted (Add. #1)	

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NEW ENGLAND DIVISION
BOSTON, MASS

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DRAWN BY H.L.
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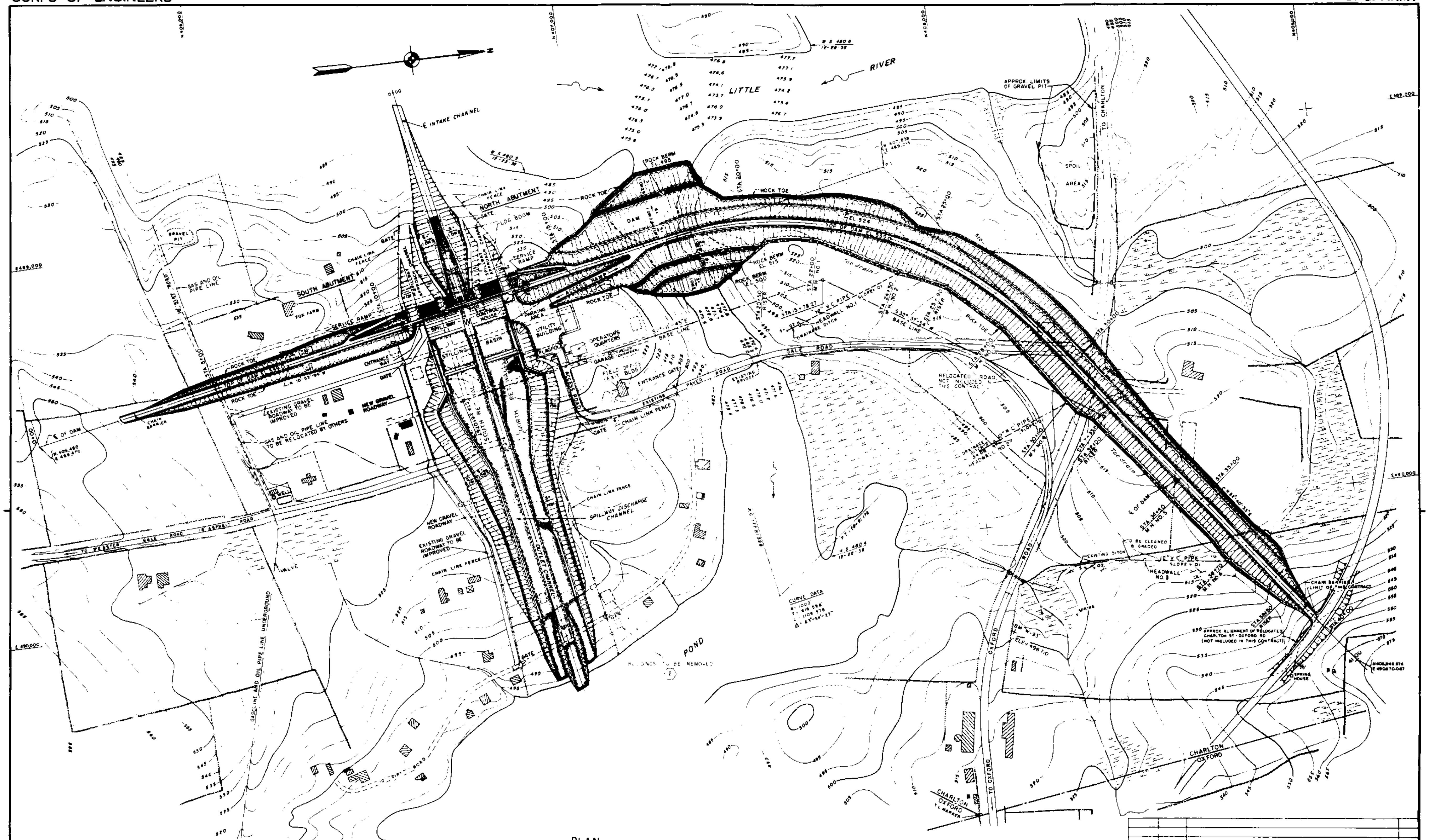
CHIEF, PLANN. ENG'G BRANCH
APPROVED
CHIEF, ENGINEERING DIV.
APPROVED
LT. COL. C.E. ASS'T DIVISION ENGINEER

THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
GEOLOGIC SECTIONS
LITTLE RIVER MASSACHUSETTS

DATE APR. 19[illegible]



PLAN

SCALE 1" = 100'

100 0 100 200

COORDINATES TO BASE LINE STATIONS

STA 7+33.11 { N 408,349.681 / E 489,747.148

STA 15+78.27 { N 407,637.882 / E 489,291.476

STA 26+07.67 { N 406,628.072 / E 489,491.347

NOTES

Grid system based on Massachusetts State Planes Coordinates

Elevations refer to Mean Sea Level Datum

Contour interval 5 feet

Figures in hexagons indicate item numbers under which payment will be made.

For Embankment Sections, see Sheet Nos 12, 13 & 14

For Embankment Drainage, see Sheet No. 15

For Log Boom Details, see Sheet No. 15

For Spillway and Outlet Works see Sheet No. 16

REVISION	DATE	DESCRIPTION	BY

CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON MASS

DES. BY	DR. BY	CK. BY
	S.G.	

THAMES RIVER FLOOD CONTROL

BUFFUMVILLE DAM

DAM

PLAN

LITTLE RIVER MASSACHUSETTS

PROJECT ENGINEER

SUBMITTED BY

CHIEF PLANN. & REP'TS BRANCH

APPROVED

CHIEF ENGINEERING DIV

APPROVED

LT COL C E ASST. DIVISION ENGINEER

DATE APR. 1956

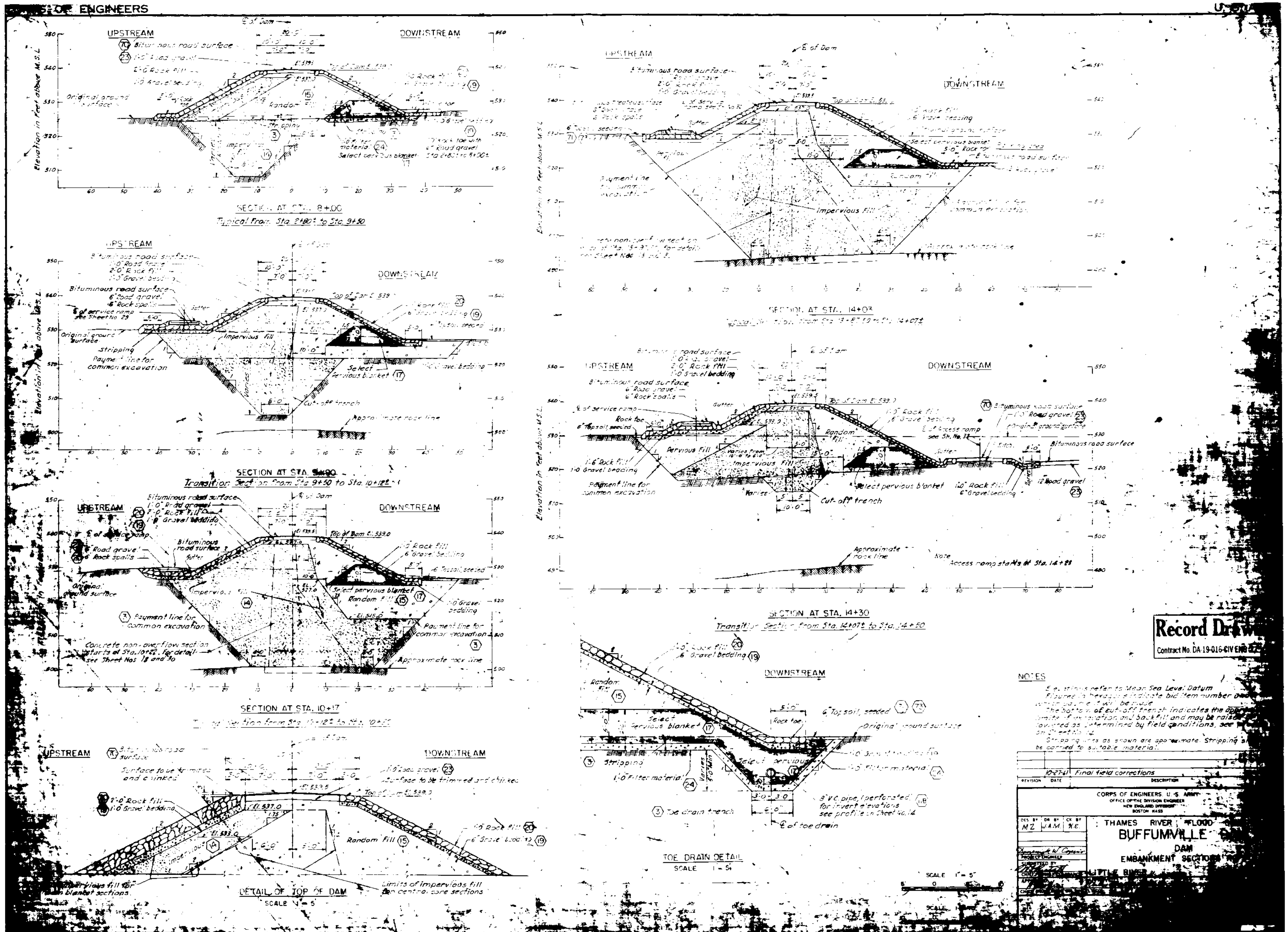
SCALE: AS SHOWN

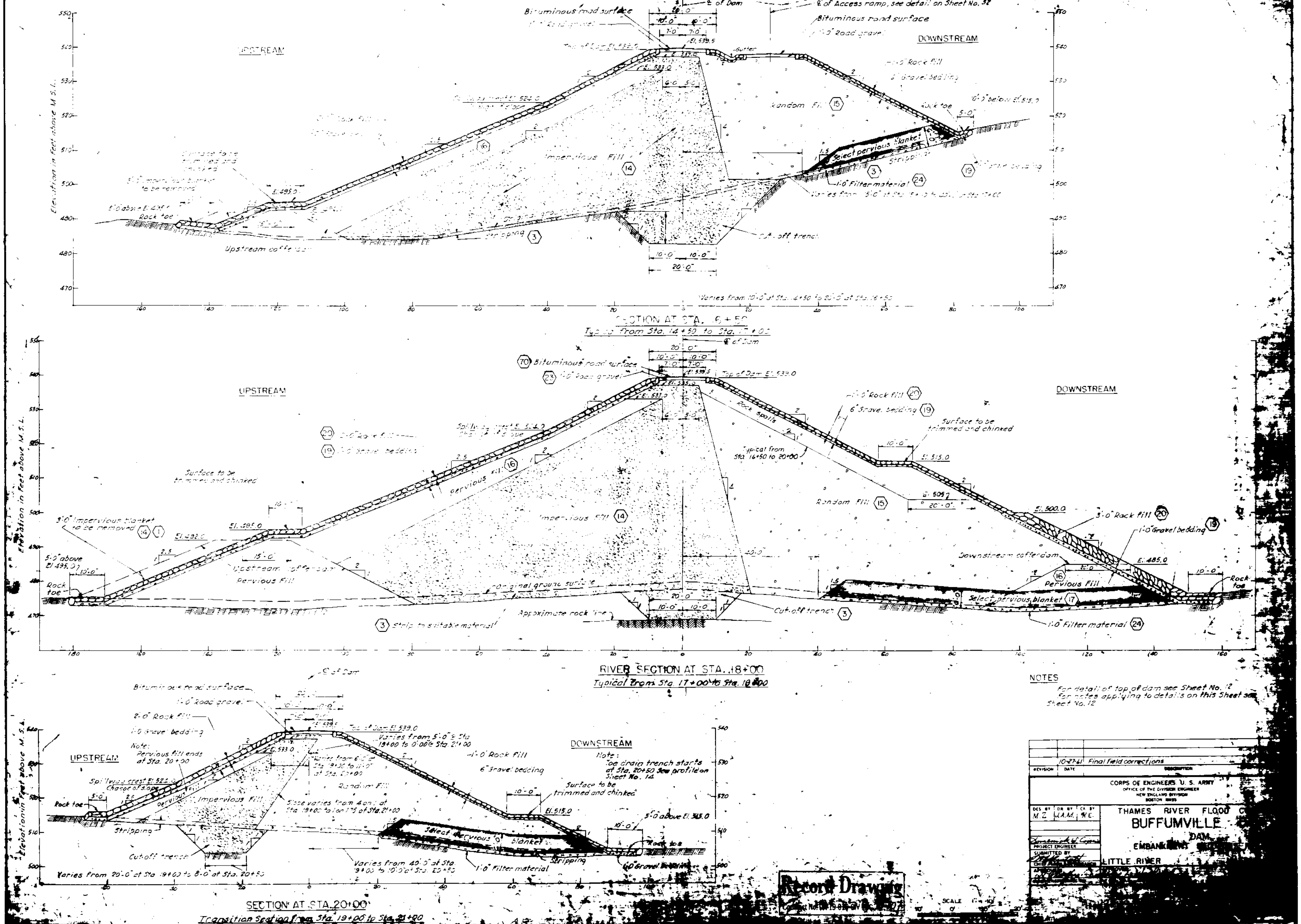
SPEC. NO. CIV. ENG-19-016-57-2

DRAWING NUMBER

TH-1-1293

SHEET 11 OF 68


CORPS OF ENGINEERS
UPSTREAM
DOWNSTREAM
SECTION AT STA. 8+00
Typical From Sta. 2+80± to Sta. 9+50
SECTION AT STA. 9+90
Transition Section from Sta. 9+50 to Sta. 10+12±
SECTION AT STA. 10+17
Elevation in Feet above M.S.L.
Bituminous road surface
1'-0" Road gravel
2'-0" Rock fill
1'-0" Gravel bedding
Original ground surface
Stripping
Payment line for common excavation
Impervious fill
Random fill
Select pervious blanket
Cut-off trench
Approximate rock line
Top of Dam El. 539.0
Concrete non-overflow section starts at Sta. 10+22. For detail see Sheet Nos. 18 and 30
DETAIL OF TOP OF DAM
Limits of impervious fill on central core sections
SECTION AT STA. 14+03
SECTION AT STA. 14+30
Transition Section from Sta. 14+07± to Sta. 14+50
Note
Access ramp starts at Sta. 14+28
TOE DRAIN DETAIL
6" Topsoil, seeded
8" V.C. pipe, (perforated) for invert elevations see profile on Sheet No. 14
Toe drain trench
℄ of toe drain
Record Drawing
NOTES
Elevations refer to Mean Sea Level Datum
10-27-61 Final field corrections
REVISION
DATE
DESCRIPTION
CORPS OF ENGINEERS U.S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.
THAMES RIVER FLOOD
BUFFUMVILLE DAM
EMBANKMENT SECTIONS
LITTLE RIVER



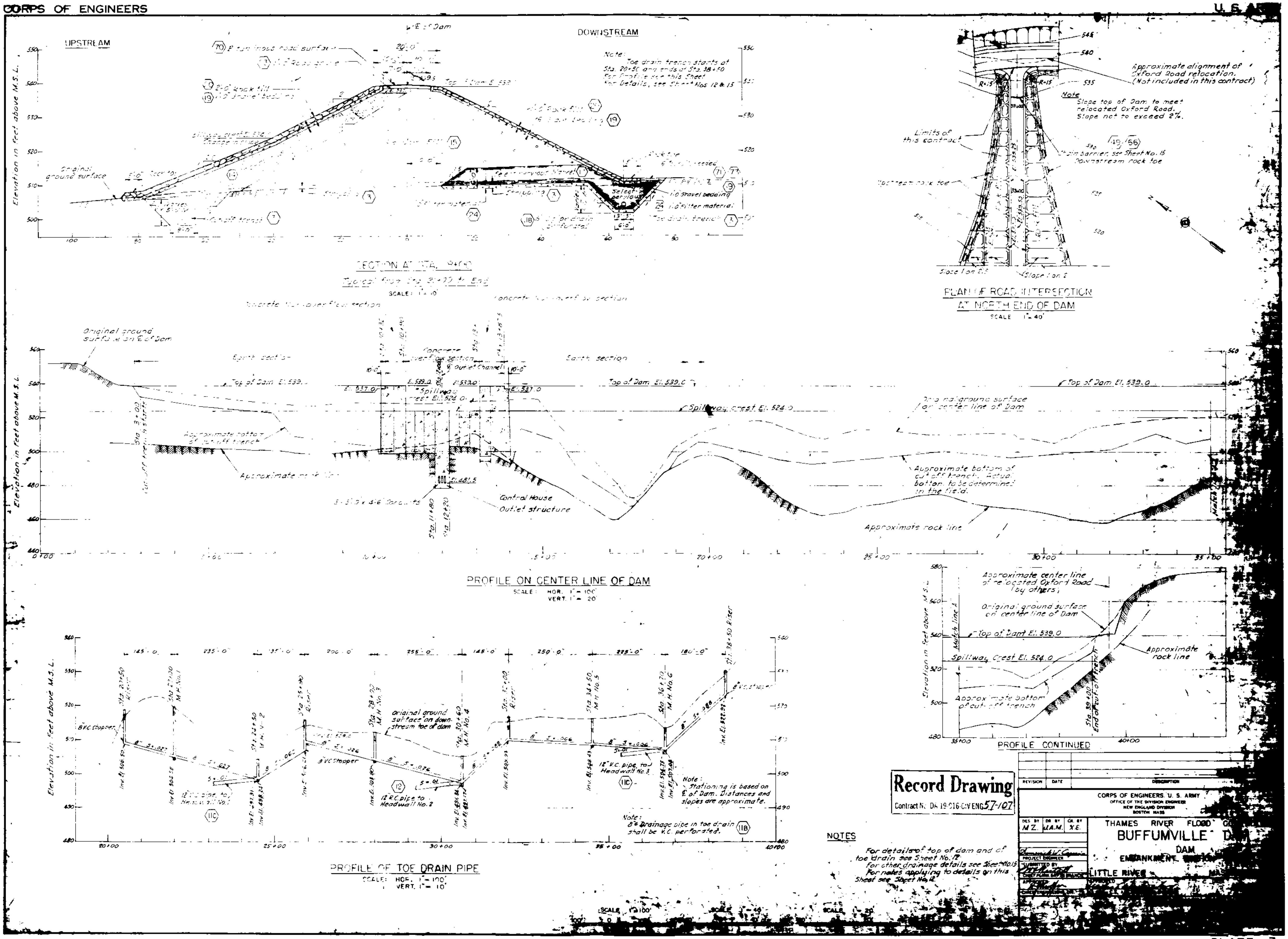
NOTES
For detail of top of dam see Sheet No. 12
For notes applying to details on this Sheet see Sheet No. 12

10-27-41 Final field corrections

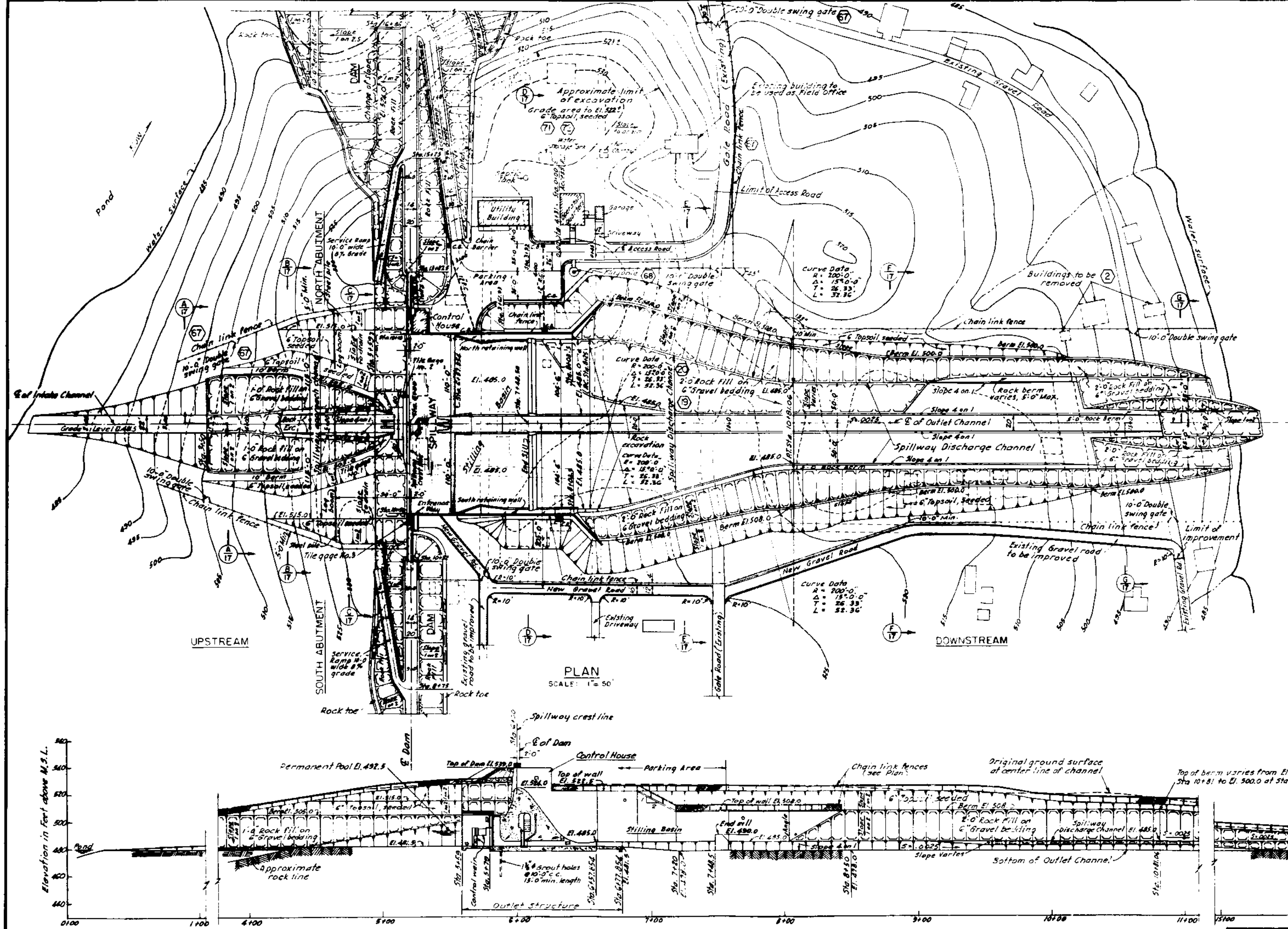
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON MASS

THAMES RIVER FLOOD C
BUFFUMVILLE DAM
EMBANKMENT
LITTLE RIVER

Record Drawing



UPSTREAM
DOWNSTREAM
Elevation in feet above M.S.L.
SECTION AT STA. 24+00
SCALE: 1" = 10'
PLAN OF ROAD INTERSECTION AT NORTH END OF DAM
SCALE 1" = 40'
Approximate alignment of Oxford Road relocation. (Not included in this contract)
Note
Slope top of Dam to meet relocated Oxford Road. Slope not to exceed 2%.
Limits of this contract
Original ground surface on ℄ of Dam
Earth section
Top of Dam El. 539.0
Spillway crest El. 524.0
Approximate bottom of cut-off trench
Approximate rock line
Control House
Outlet structure
Approximate bottom of cut-off trench. Actual bottom to be determined in the field.
PROFILE ON CENTER LINE OF DAM
SCALE: HOR. 1" = 100' VERT. 1" = 20'
Approximate center line of relocated Oxford Road (by others)
Original ground surface on center line of Dam
Approximate rock line
Approximate bottom of cut-off trench
PROFILE CONTINUED
Original ground surface on downstream toe of dam
Note:
Stationing is based on ℄ of Dam. Distances and slopes are approximate.
Note:
8" Drainage pipe in toe drain shall be V.C. perforated.
PROFILE OF TOE DRAIN PIPE
SCALE: HOR. 1" = 100' VERT. 1" = 10'
NOTES
For details of top of dam and of toe drain see Sheet No. 12. For other drainage details see Sheet No. 15. For notes applying to details on this Sheet see Sheet No. 14.
Record Drawing
Contract No. DA 19-016-CIVENG-57-107
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.
THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
DAM
EMBANKMENT
LITTLE RIVER



NOTES

Elevations refer to Mean Sea Level Datum.
For South Abutment plan and details see Sheet Nos. 29 & 30.
For North Abutment plan and details see Sheet Nos. 32-33 and 34.
For Spillway plan and details see Sheet Nos. 18 & 19.
For Outlet Structure details see Sheet Nos. 20 thru 24.
For Control House details see Sheet Nos. 25-26 & 27.
For Utility Building details see Sheet Nos. 62 thru 66.
For Operators Quarters details see Sheet Nos. 58 thru 61.
For Building Area and Access Road see Sheet No. 57.
Figures in hexagons indicate bid items under which payment will be made.
For log boom details see Sheet No. 15.

SCALE 1" = 30'
30' 0 30' 60'

SCALE 1" = 50'
50' 0 50' 100'

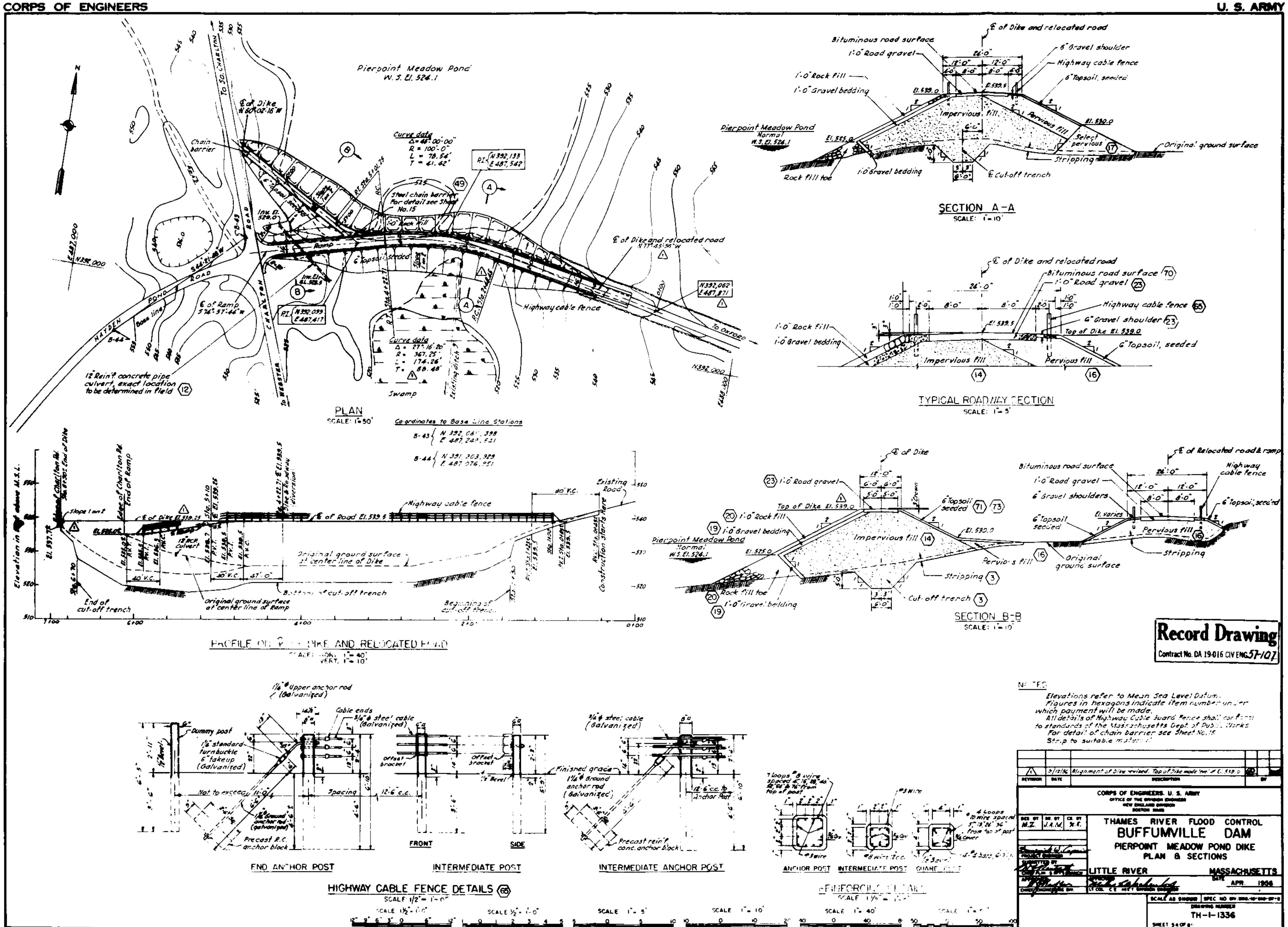
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

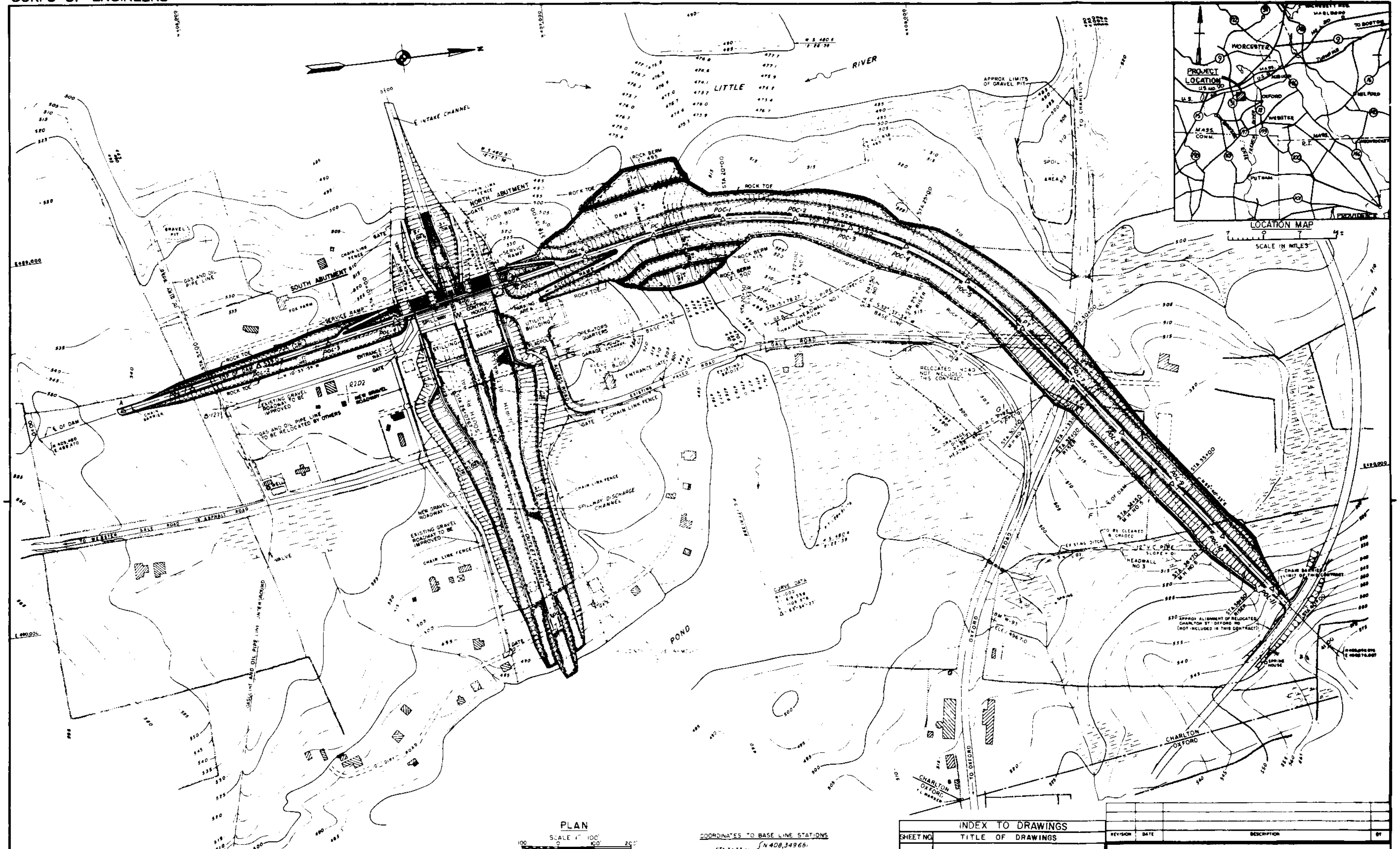
DES BY M.Z. | DR BY J.J.M. | CK BY

THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
SPILLWAY & OUTLET WORKS
PLAN & SECTION

PROJECT ENGINEER
SUBMITTED BY
APPROVED
CHIEF ENGINEERING DIV.

LITTLE RIVER MASSACHUSETTS
DATE APR 1956
SCALE AS SHOWN
DRAWING NUMBER TH-1-1298


Pierpoint Meadow Pond
W. S. El. 524.1
Curve data
Δ = 48°-00'-00"
R = 100'-0"
L = 78.54'
T = 41.42'
Steel chain barrier For detail see Sheet No. 15
Chain barrier
℄ of Dike
℄ of Dike and relocated road
Highway cable fence
℄ of Ramp
Ramp
To Oxford
To So. Charlton
To Webster
CHARLTON ROAD
HAYDEN POND ROAD
Base line
Swamp
Curve data
12" Rein't concrete pipe culvert, exact location to be determined in field (12)
PLAN
SCALE: 1"=50'
Co-ordinates to Base Line Stations
B-43 N 392,041.398 E 487,249.531
B-44 N 391,903.929 E 487,076.951
PROFILE ON ℄ OF DIKE AND RELOCATED ROAD
SCALE: HOR. 1"=40' VERT. 1"=10'
Elevation in feet above M.S.L.
Slope 1 on 2
℄ of Road El. 539.5
Highway cable fence
Original ground surface at center line of Dike
Bottom of cut-off trench
Beginning of cut-off trench
End of cut-off trench
Original ground surface at center line of Ramp
Existing Road
Construction starts here
80' V.C.
40' V.C.
SECTION A-A
SCALE: 1"=10'
Bituminous road surface
1'-0" Road gravel
1'-0" Rock fill
1'-0" Gravel bedding
Impervious fill
Pervious fill
Select pervious (17)
Stripping
Original ground surface
Rock fill toe
℄ Cut-off trench
6" Gravel shoulder
Highway cable fence
6" Topsoil, seeded
Pierpoint Meadow Pond Normal W. S. El. 524.1
TYPICAL ROADWAY SECTION
SCALE: 1"=5'
Top of Dike El. 539.0
6" Topsoil, seeded
Impervious fill (14)
Pervious fill (16)
SECTION B-B
SCALE: 1"=10'
Stripping (3)
Cut-off trench (3)
Original ground surface
℄ of Relocated road & ramp
6" Gravel shoulders
Record Drawing
Contract No. DA 19-016 CIV ENG 57-107
NOTES
Elevations refer to Mean Sea Level Datum.
Figures in hexagons indicate item number under which payment will be made.
All details of Highway Cable Guard Fence shall conform to standards of the Massachusetts Dept. of Public Works.
For detail of chain barrier see Sheet No. 15
Strip to suitable material.
Alignment of Dike revised. Top of Dike made level @ El. 539.0
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.
THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
PIERPOINT MEADOW POND DIKE
PLAN & SECTIONS
LITTLE RIVER
MASSACHUSETTS
APR. 1956
SCALE AS SHOWN
TH-1-1336
SHEET 54 OF 81
END ANCHOR POST
INTERMEDIATE POST
INTERMEDIATE ANCHOR POST
FRONT
SIDE
HIGHWAY CABLE FENCE DETAILS (65)
SCALE 1/2" = 1'-0"
Dummy post
1 1/4" standard turnbuckle 6" takeup (Galvanized)
1 1/4" Upper anchor rod (Galvanized)
Cable ends
3/4" steel cable (Galvanized)
Offset bracket
Precast R.C. anchor block
Precast rein't conc. anchor block
Finished grade
12'-6" c.c.
ANCHOR POST
INTERMEDIATE POST
GUARD RAIL
REINFORCING DETAILS



COORDINATES TO BASE LINE STATIONS

STA 7+33.11 {N 408,349.661 / E 489,747.148

STA 15+78.27 {N 407,637.882 / E 489,291.476

STA 26+07.67 {N 406,628.072 / E 489,491.347

LEGEND	
POL-2 △	Crest Monument, POL-2 signifies No.
B-127	Control Point for Vertical and Horizontal Control.

INDEX TO DRAWINGS

SHEET NO.	TITLE OF DRAWINGS
PLATE-1	INSTRUMENTATION GENERAL PLAN
PLATE-2	CREST SURVEY MONUMENT GENERAL LAYOUT; LOCATION
PLATE-3	CREST SURVEY MONUMENTS HORIZONTAL AND VERTICAL MOVEMENT
PLATE-4	TOE DRAIN PROFILE AND SECTIONS
PLATE-5	TOE DRAIN DETAILS

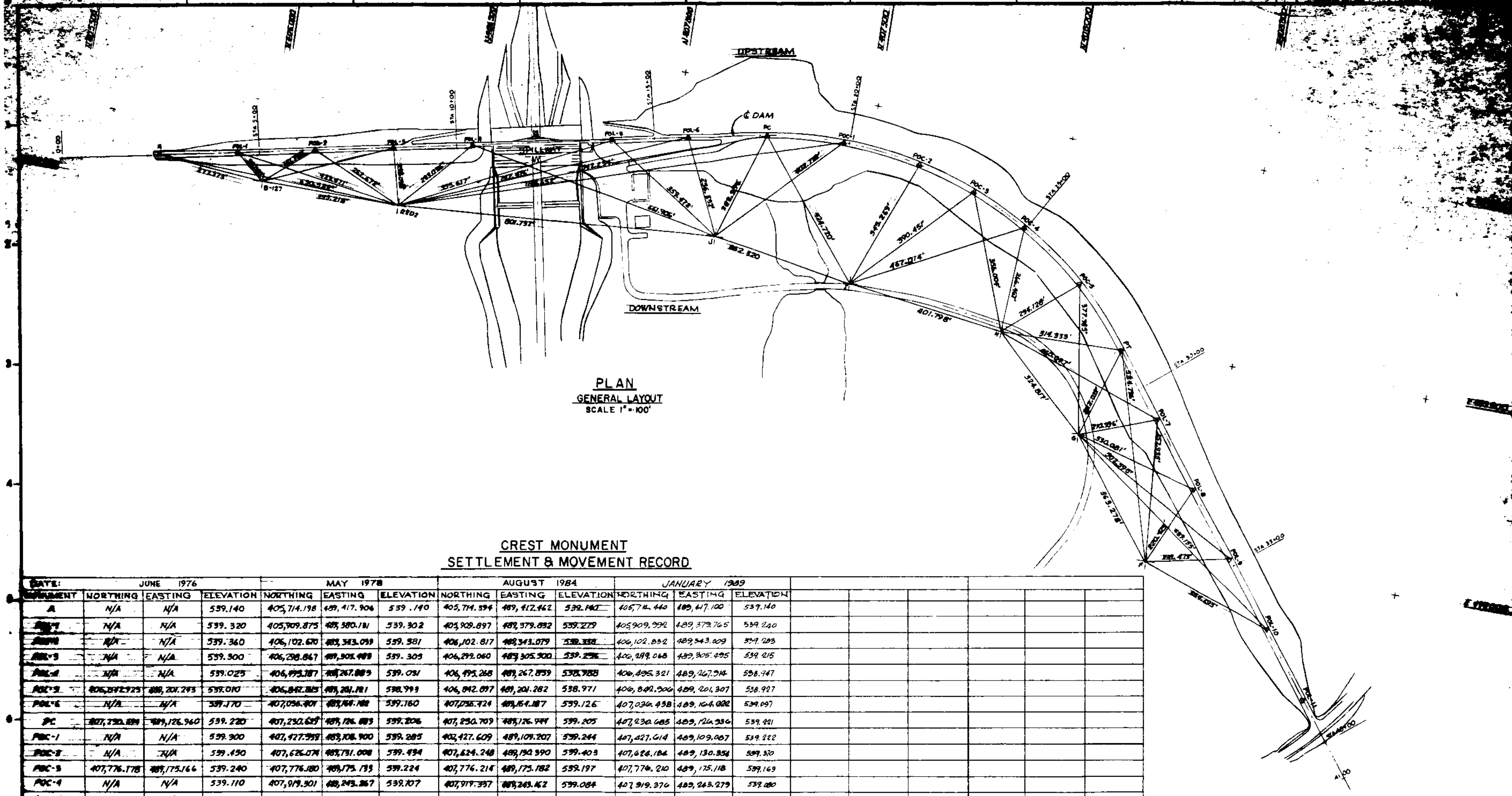
REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
INSTRUMENTATION GENERAL PLAN
LITTLE RIVER MASSACHUSETTS

DESIGN BY: P. V. T.
DRAWN BY: P. V. T.
CHECK BY: J. C. H.

GEOTECH. ENG. DIV.
PLATE NO. 10
SCALE: AS SHOWN
DATE: MARCH 1991



CREST MONUMENT SETTLEMENT & MOVEMENT RECORD

DATE:	JUNE 1976			MAY 1978			AUGUST 1984			JANUARY 1989		
MONUMENT	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION
A	N/A	N/A	539.140	405,714.198	489,417.906	539.140	405,714.394	489,417.462	539.140	405,714.440	489,417.100	539.140
[illegible]	N/A	N/A	539.320	405,909.875	489,380.181	539.302	405,909.897	489,379.892	539.279	405,909.992	489,379.765	539.240
[illegible]	N/A	N/A	539.360	406,102.670	489,343.099	539.381	406,102.817	489,343.079	539.338	406,102.832	489,343.009	539.283
POL-3	N/A	N/A	539.300	406,298.867	489,305.489	539.305	406,299.060	489,305.500	539.296	406,299.068	489,305.495	539.215
POL-4	N/A	N/A	539.025	406,495.187	489,267.889	539.091	406,495.268	489,267.859	538.988	406,495.321	489,267.914	538.947
POL-5	406,842.925	489,201.293	539.010	406,842.885	489,201.181	538.993	406,842.897	489,201.282	538.971	406,842.906	489,201.307	538.927
POL-6	N/A	N/A	539.170	407,036.401	489,164.188	539.160	407,036.424	489,164.187	539.126	407,036.438	489,164.002	539.097
PC	407,230.889	489,126.960	539.220	407,230.689	489,126.883	539.206	407,230.709	489,126.944	539.205	407,230.685	489,126.936	539.221
POC-1	N/A	N/A	539.300	407,427.559	489,108.900	539.285	407,427.609	489,109.207	539.244	407,427.614	489,109.067	539.222
POC-2	N/A	N/A	539.450	407,626.074	489,131.008	539.434	407,624.248	489,130.390	539.403	407,624.184	489,130.354	539.370
POC-3	407,776.178	489,175.166	539.240	407,776.180	489,175.135	539.224	407,776.214	489,175.182	539.197	407,776.210	489,175.118	539.169
POC-4	N/A	N/A	539.110	407,919.301	489,243.267	539.107	407,919.357	489,243.162	539.084	407,919.376	489,243.279	539.080
POC-5	N/A	N/A	539.130	408,079.859	489,358.596	539.118	408,079.821	489,358.576	539.096	408,079.883	489,358.628	539.051
PT	408,214.485	489,503.439	539.170	408,214.512	489,503.384	539.174	408,214.473	489,503.373	539.154	408,214.537	489,503.391	539.102
POL-7	N/A	N/A	539.310	408,334.422	489,660.885	539.368	408,334.412	489,660.907	539.297	408,334.470	489,660.944	539.260
POL-8	N/A	N/A	539.100	408,454.490	489,818.607	539.110	408,454.465	489,818.578	539.107	408,464.499	489,818.610	539.070
POL-9	N/A	N/A	539.100 ?	408,574.993	489,976.787	539.111	408,574.885	489,976.918	539.087	408,574.934	489,976.900	539.049
POL-10	408,695.184	490,134.889	539.110	408,695.190	490,134.869	539.115	408,695.172	490,134.877	539.105	408,695.184	490,134.908	539.067
POL-11	N/A	N/A	539.260	N/A	N/A	539.263	N/A	N/A	539.256	N/R	N/R	539.256

CONTROL POINTS LOCATION AND ELEVATION RECORD

CONTROL POINT	NORTHING	EASTING
B-127	405,991.470	489,430.580
R2-D2	406,544.259	489,446.449
J	407,144.463	489,396.887
I	407,502.336	489,453.419
H	407,900.294	489,508.821
G	408,195.853	489,732.511
F	408,560.312	490,017.858

NOTE:

1989 Survey - Field notes indicates that points POC 4 to POL 11 are "slightly tipped".

SAFETY PAYS

GRAPHIC SCALES

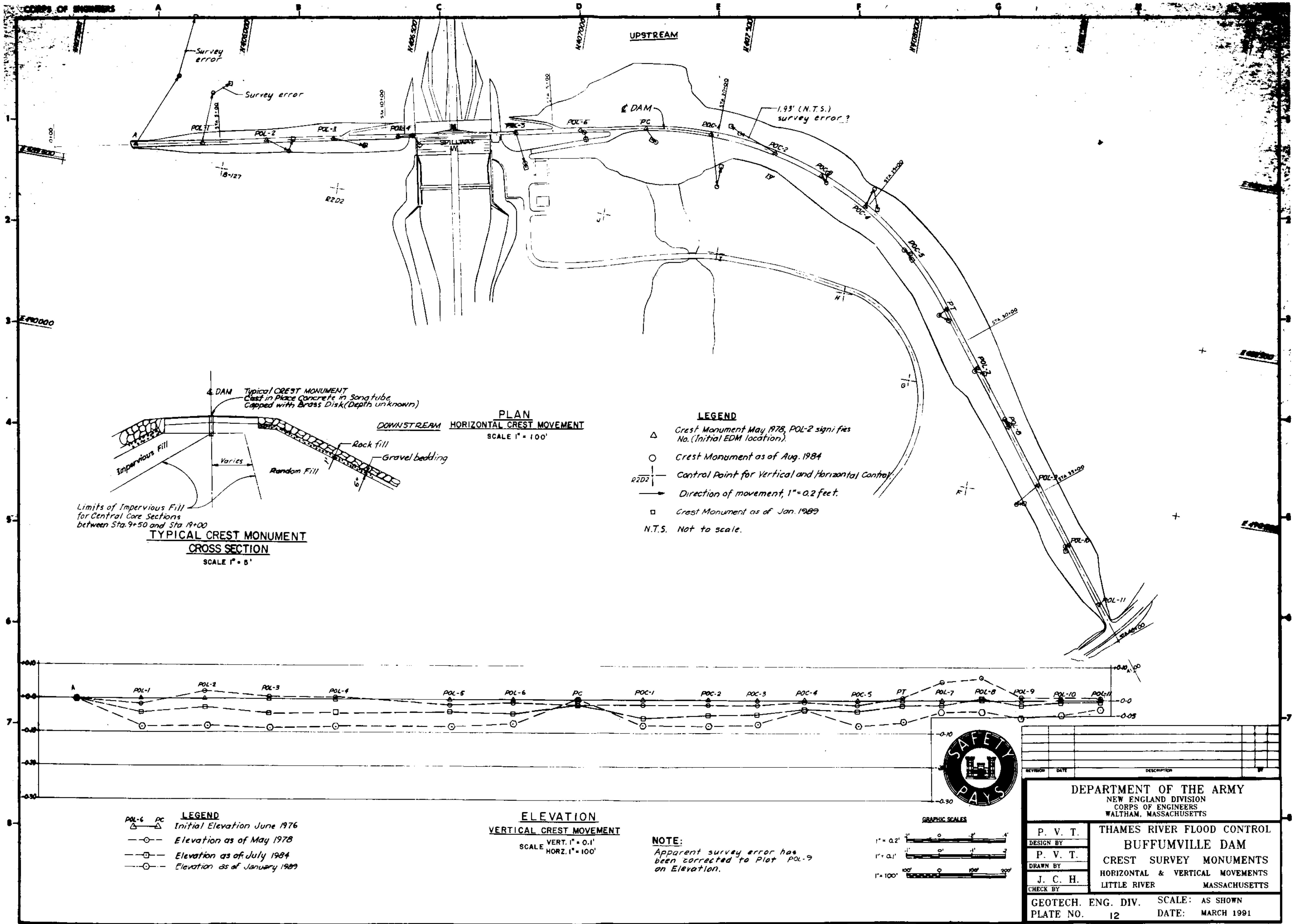
1" = 100' 100' 0 100' 200'

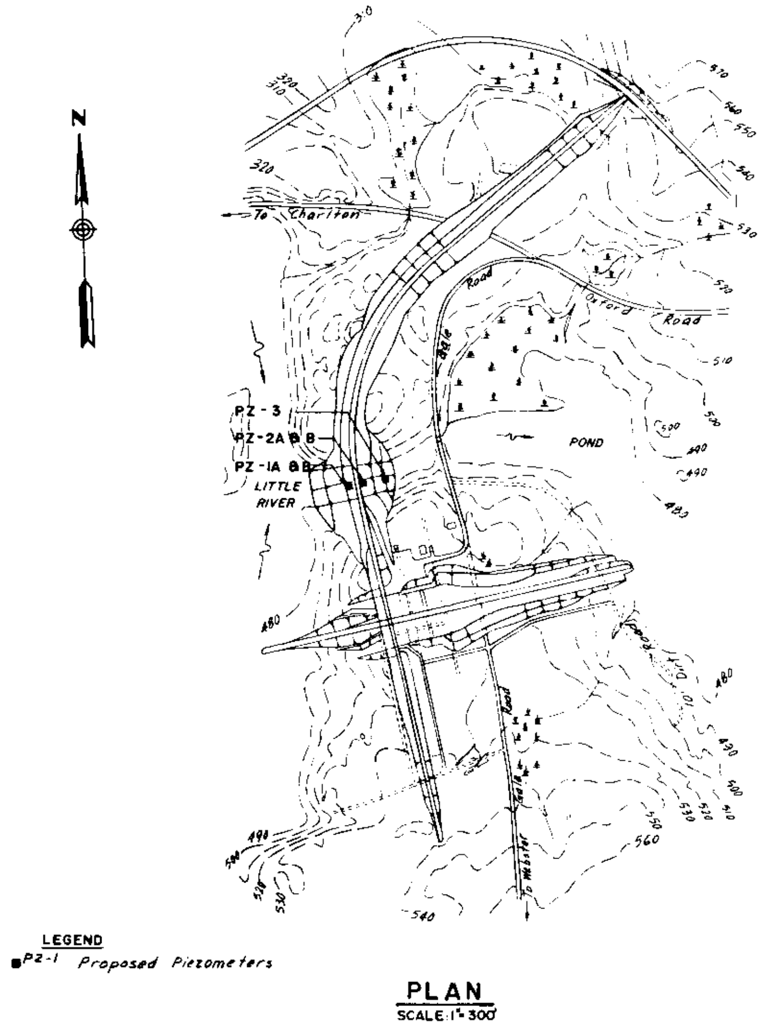
REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

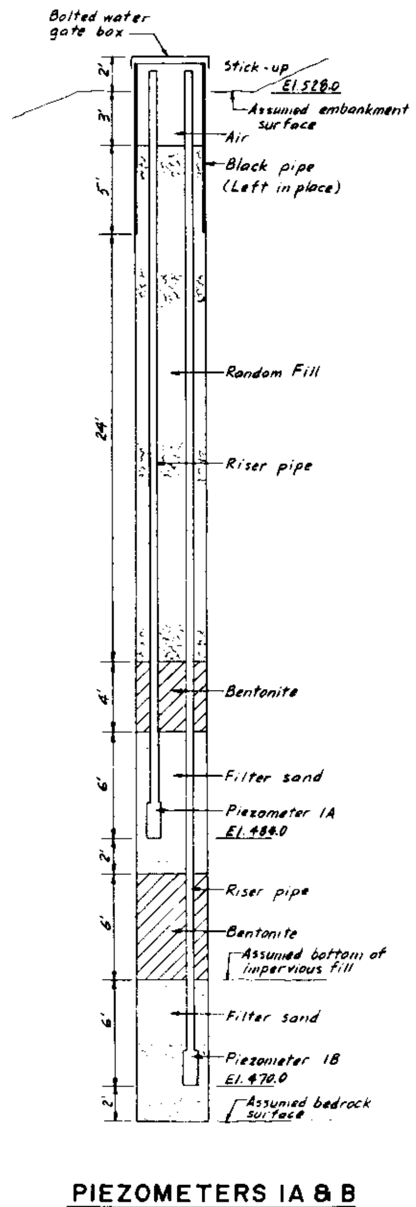
P. V. T. DESIGN BY	THAMES RIVER FLOOD CONTROL
P. V. T. DRAWN BY	BUFFUMVILLE DAM CREST SURVEY MONUMENTS GENERAL LAYOUT LOCATION
J. C. H. CHECK BY	LITTLE RIVER MASSACHUSETTS

GEOTECH. ENG. DIV. SCALE: AS SHOWN
PLATE NO. 11 DATE: MARCH 1991

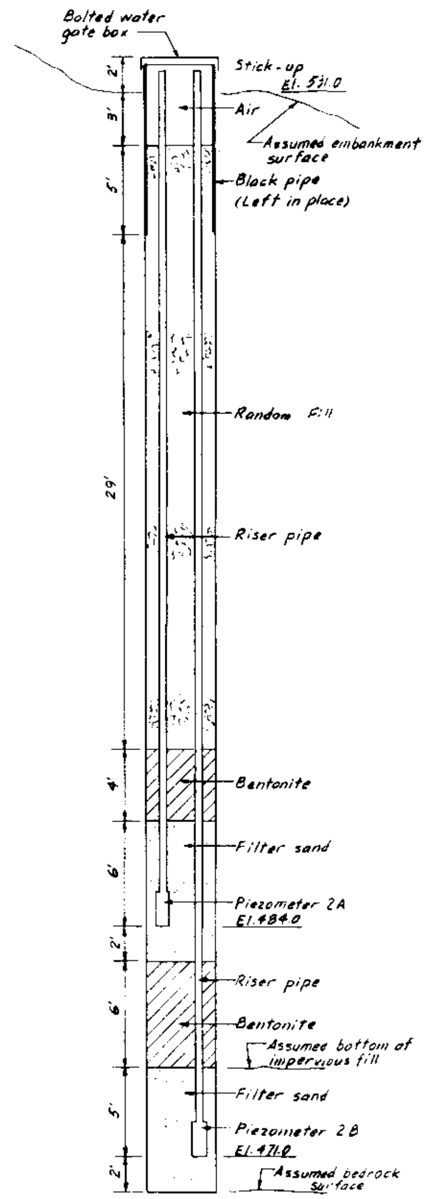

CORPS OF ENGINEERS
UPSTREAM
Survey error
Survey error
1.93' (N.T.S.) survey error ?
℄ DAM
PC
SPILLWAY
POL-1
POL-2
POL-3
POL-4
POL-5
POL-6
POC-1
POC-2
POC-3
POC-4
POC-5
PT
POL-7
POL-8
POL-9
POL-10
POL-11
R2D2
B-127
E 490000
℄ DAM Typical CREST MONUMENT Cast in Place Concrete in Sonotube Capped with Brass Disk (Depth unknown)
Impervious Fill
Varies
Random Fill
Rock fill
Gravel bedding
Limits of Impervious Fill for Central Core Sections between Sta. 9+50 and Sta 19+00
TYPICAL CREST MONUMENT
CROSS SECTION
SCALE 1" = 5'
DOWNSTREAM
PLAN
HORIZONTAL CREST MOVEMENT
SCALE 1" = 100'
LEGEND
Crest Monument May 1978, POL-2 signifies No. (Initial EDM location).
Crest Monument as of Aug. 1984
Control Point for Vertical and Horizontal Control
Direction of movement, 1" = 0.2 feet.
Crest Monument as of Jan. 1989
N.T.S. Not to scale.
+0.10
0.0
-0.05
-0.10
-0.20
-0.30
LEGEND
Initial Elevation June 1976
Elevation as of May 1978
Elevation as of July 1984
Elevation as of January 1989
ELEVATION
VERTICAL CREST MOVEMENT
SCALE VERT. 1" = 0.1' HORZ. 1" = 100'
NOTE:
Apparent survey error has been corrected to plot POL-9 on Elevation.
GRAPHIC SCALES
1" = 0.2'
1" = 0.1'
1" = 100'
SAFETY PAYS
REVISION DATE DESCRIPTION BY
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS
P. V. T.
DESIGN BY
P. V. T.
DRAWN BY
J. C. H.
CHECK BY
THAMES RIVER FLOOD CONTROL
BUFFUMVILLE DAM
CREST SURVEY MONUMENTS
HORIZONTAL & VERTICAL MOVEMENTS
LITTLE RIVER MASSACHUSETTS
GEOTECH. ENG. DIV.
PLATE NO. 12
SCALE: AS SHOWN
DATE: MARCH 1991



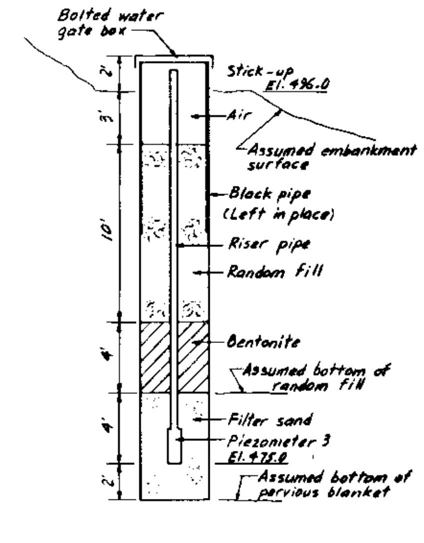
PLAN
SCALE: 1" = 300'



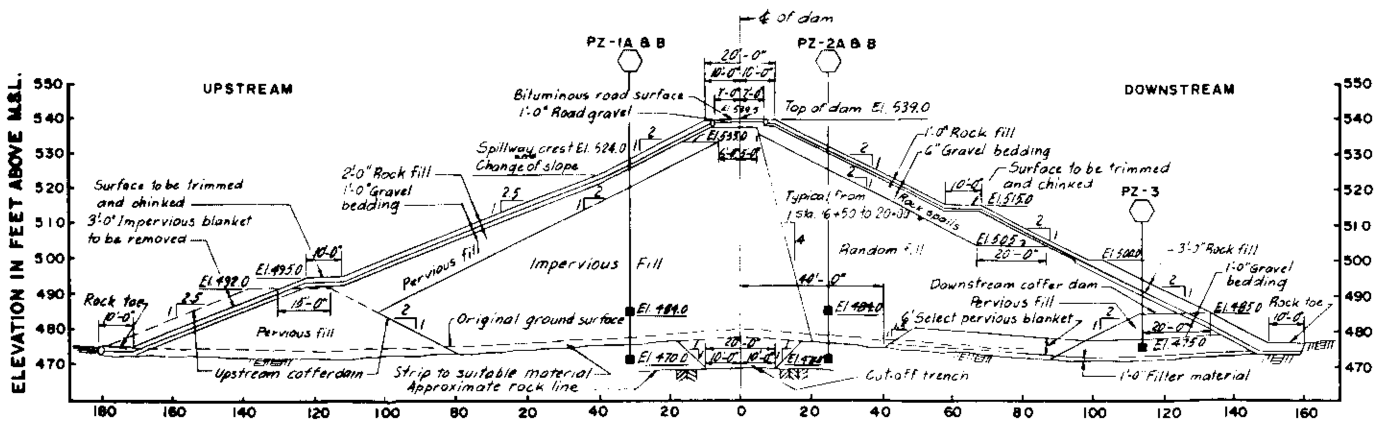
PIEZOMETERS 1A & B
N. T. S.



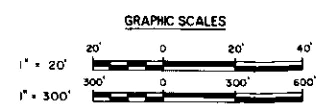
PIEZOMETERS 2A & B
N. T. S.



PIEZOMETER 3
N. T. S.



RIVER SECTION AT STA. 18 + 00
(TYPICAL FROM STA. 17 + 00 TO STA. 19 + 00)
SCALE: 1" = 20'



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT
THAMES RIVER BASIN

BUFFUMVILLE DAM

PROPOSED PIEZOMETERS

LOCATIONS AND DETAILS

DES. BY:
DR. BY: A. C.
CK. BY:

GEOTECH. ENG. BR.
PLATE 13

SCALE: AS SHOWN
DATE: AUG. 1991